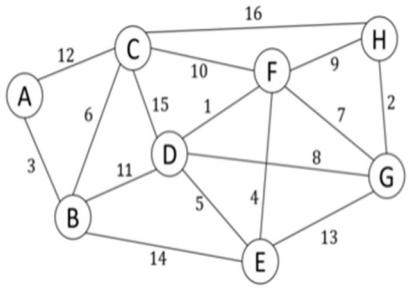
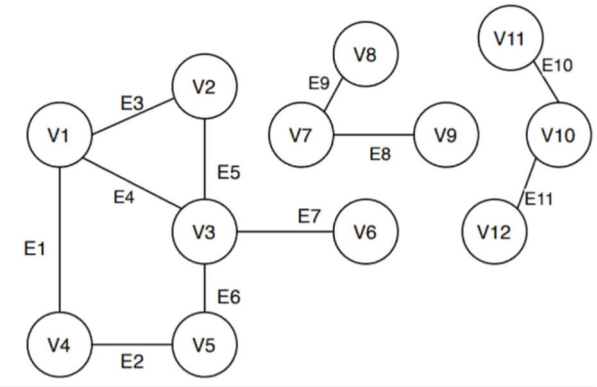
Shiv Nadar University Chennai

End Semester Examinations, 2023-2024 Even

Question Paper

Name of the Program: Common to B.Tech. AI & DS and B.Tech. CSE (Cyber Security)		Semester: II
Course Code & Name: CS1006T DATA STRUCTURES		
Regulation 2021		
Time: 3 Hours		Maximum: 100 Marks

Q. No.		Questions	Marks	CO#	KL#
1	a	Suppose you are asked to implement a queue using stacks. How many minimum number of stacks are required to implement a queue? Write the Enqueue and Dequeue functions using the stack operations.	5	CO2	KL2
	b	How will you use a single array (array size is taken as *N*) to implement two stacks? Write push and pop functions for each stack, incorporating the boundary conditions.	5	CO2	KL3
2	a	What is the value of the postfix expression 2 3 4 + * 7/ and draw the expression tree for the same.	5	CO2	KL3
	b	Represent a polynomial of degree '*n*' using a linked list, where n is obtained as input. Write an algorithm/pseudo-code to find the derivative of the polynomial with degree '*n*'. (input: Polynomial; output: derivative of polynomial)	5	CO2	KL3
3	a	A binary tree is represented in array T. The contents of the array T = [0,1,2,3,4,5,6,null,10,null,8,null,null,7,null,11,null,9,null,null,12], where null represents the no node available. Draw the binary tree ***T*** corresponding to the array T. Is T a complete binary tree? Justify your answer with a proper definition. Find the pre-order, post-order and in-order of ***T***.	8	CO3	KL4
	b	Which of the following is/are true? Give your answer with justification. i) Search in open hashing is always faster than search in AVL tree. ii) A graph can also be used to represent a linear data structure. iii) An array can be used to represent only a linear data structure. iv) Every tree is a graph.	2	CO5	KL2
4	a	Construct an AVL tree with the keys 1, 2, 5, 7, 8, 22, 57, 21, 9, 11, and 10, showing each of the required rotations. Construct a binary search tree without balancing for the same set of keys. Compare and discuss the change in the height of both the trees.	14	CO5	KL5
		OR			
		Construct a B-tree with the keys 1, 2, 5, 7, 8, 22, 57, 21, 9, 11, and 10, showing each required rotation. A node can have a maximum of 2 keys and 3 children. Construct a binary search tree without balancing for the same set of keys. Compare and discuss the change in the height of both the trees			
	b	Write an algorithm / pseudo-code, which takes the pre-order traversal of a binary search tree as input and outputs the post-order traversal of the tree. What modifications are needed to the algorithm if the input tree is not a binary search tree?	6	CO3	KL4
5	a	Write the worst, best and average time complexity of insertion and search in each of the following i) Hashing without key collision ii) Hashing with key collision, using open hashing linear probing iii) Hashing with key collision, using open hashing quadratic probing Justify your answers.	5	CO4	KL4
	b	Explain how deletion will be handled in the following different hashing techniques: i. Rehashing with a load factor of 0.5; ii. Extensible hashing Justify your answers.	5	CO3	KL4

	c	Given the input {3471, 2133, 1763, 4919, 3444, 6979, 9189}, a fixed table size of 7, and a hash function H_1(Key) = (Key mod 7) and following collision resolution techniques i) Hashing with separate chaining ii) Hashing with key collision, using open hashing linear probing iii) Hashing with key collision, using open hashing quadratic probing Draw the final hash table. Repeat the same for a fixed table size of 10, and a hash function H_2(Key) = (Key mod 10).	10	CO3	KL3
6	a	Construct the cost adjacency matrix for the following undirected graph. Perform Breadth-first search traversal from node D. 	10	CO3	KL3
	b	Design the Structure/Class for a node in a tree. The nodes in the tree can have any number of children. The designed structure/class must be space efficient. Justify your answer on space efficiency.	5	CO4	KL4
7	a	**Connected component of a graph G:** A connected component of an undirected graph is a maximal set of nodes such that each pair of nodes is connected by a path. For example, the graph shown in the illustration has three connected components. Component_1 = {V1,V2,V3,V4,V5,V6}, Component_2 = {V7,V8,V9}, Component_3 ={V10, V11,V12}  Write an algorithm with time complexity analysis to find the **number of connected components** in the given graph.	5	CO4	KL4
	b	**A cycle is a path in the graph in which at least one node is visited more than once.** Write an algorithm/pseudo-code which takes a graph as input and outputs *'yes'* if **a cycle** is present; otherwise, it is '*no'*. The algorithm/pseudocode must use only the operations of the ADT that you have used to store the graph. Use step count method to obtain the tightest upper bound.	5	CO4	KL4
8	a	Let 50, 30, 40, 20,15, 12, 10, 5, 2, 11, 1, and 4 be the elements from index 1 in array A. Assume that the array represents max heap. What are the children of 15? Is Max heap linear data structure? If yes, why? Otherwise, why not?	5	CO4	KL3

KL – Bloom's Taxonomy Levels
(KL1: Remembering, KL2: Understanding, KL3: Applying, KL4: Analyzing, KL5: Evaluating, KL6: Creating)
CO – Course Outcomes
